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Indian Standard

ENDURANCE (LIFE) TEST FOR ELECTRONIC AND ELECTRICAL COMPONENTS

PART I THERMAL ENDURANCE

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ENDURANCE (LIFE) TEST FOR ELECTRONIC AND ELECTRICAL COMPONENTS

PART I THERMAL ENDURANCE

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Indian Standard

ENDURANCE (LIFE) TEST FOR ELECTRONIC AND ELECTRICAL COMPONENTS

PART I THERMAL ENDURANCE

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 6 June 1979, after the draft finalized by the Reliability of Electronic and Electrical Components and Equipment Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard (Part I) deals with thermal endurance (life) test with or without electrical loading applicable to electronic, electromechanical and electrical components. The other part (Part II) of this standard covers mechanical endurance (life) test.

0.3 This test is primarily intended to be used as part of the type tests, lot acceptance tests or reliability evaluation tests when called for by the relevant component specification which should also give the information as required in **13**.

0.4 This standard is one of a series of Indian Standards on reliability of electronic and electrical components and equipment.

1. SCOPE

1.1 This standard (Part I) describes a uniform test procedure for carrying out thermal endurance (life) test with or without electrical loading on electronic, electromechanical and electrical components.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:9000 (Part I)-1977* shall apply.

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*Basic environmental testing procedures for electronic and electrical items: Part I General.

3. OBJECT

3.1 The object of this test is to assess the effects of elevated temperatures with or without electrical loading for a specified duration of time on electronic, electromechanical and electrical components.

4. TEST CHAMBER

4.1 The test chamber shall conform to the relevant provision of IS : 9002 (Part II)-1977* as applicable for carrying out dry heat test in accordance with IS : 9000 (Part III)-1977† both for non-heat dissipating and heat dissipating items.

4.2 The test chamber used for this test shall be capable of maintaining the specified temperature within the required tolerance [*see* **9.1**(a)] at any point in the working space of the chamber for the required duration [*see* **9.1**(b)].

4.3 The temperature in the chamber shall be checked with temperature sensing devices located so as to comply with the conditions specified in **2.1.2** of IS : 9000 (Part I)-1977‡.

5. PREPARATION AND MOUNTING OF COMPONENTS

5.1 The components shall be prepared and mounted as required by the relevant component specification in their normal operation position by their normal mounting means.

5.2 With this test conducted at elevated temperature, the relevant precautions as given in **5.2.1** to **5.2.3** for mounting of components and **5.2.4** shall be observed.

5.2.1 Care shall be taken during the mounting of the components to prevent excessive mechanical stress/torque (for example, bending of components during the mechanical actuations/rotations shall be avoided).

5.2.2 When groups of components are subjected to tests simultaneously or when mounting racks are used for mounting components, the mounting distances between components and the length of the leads shall be as specified by the relevant component specification. When the distance is not specified, it shall be such as to minimise the temperature of one component affecting the temperature of another.

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*Specification for equipment for environmental tests for electronic and electrical items: Part II Chamber for dry heat test.

†Basic environmental testing procedures for electronic and electrical items: Part III Dry heat test.

‡Basic environmental testing procedures for electronic and electrical items: Part I General.

5.2.3 The thermal conduction and other relevant characteristics of the mounting and connections of the components shall be specified in the relevant component specification. Components intended for use with specific mounting devices shall be mounted accordingly.

5.2.3.1 Where the components are designed for mounting in a heat sink with unspecified characteristics, the heat sink should possess thermal capacity and thermal conduction adequate to maintain its temperature close to the specified test temperature.

5.2.3.2 Where nothing is known about mounting characteristics, the thermal conduction of the mounting shall be low and for all practical purposes, the components shall be thermally isolated.

5.2.4 Components fabricated of different materials which may have a detrimental effect on each other and affect the results of the test shall not be tested simultaneously in the same chamber.

6. SEVERITIES

6.1 The severities, as indicated by temperature and duration of exposure, shall be specified in the relevant specification. The values shall be selected from those given below:

a) *Temperature*

200 ± 2°C
175 ± 2°C
155 ± 2°C
125 ± 2°C
100 ± 2°C
85 ± 2°C
70 ± 2°C
55 ± 2°C
40 ± 2°C

NOTE 1 — In the absence of other considerations, temperatures above 200°C and up to 1 000°C should be chosen from the following values:

250°C, 315°C, 400°C, 500°C, 630°C, 800°C and 1 000°C

The tolerance in each case should be ±2 percent of the above temperatures in °C.

NOTE 2 — Where due to the size of the chamber it is not feasible to maintain these tolerances, the tolerance may be widened to ±3°C up to 100°C and ±5°C up to 200°C. When this is done, the tolerance used shall be specified in the test report.

b) *Duration*

96 hours
168 hours
336 hours
672 hours
1 000 hours
2 000 hours
5 000 hours
10 000 hours

NOTE — Severities higher than 10 000 hours, if required, should be specified in the relevant component specification.

7. PRECONDITIONING

7.1 If necessary, the components may by preconditioned as required by the relevant component specification.

8. INITIAL MEASUREMENTS

8.1 The components shall be visually inspected and electrically and mechanically checked as required by the relevant specification.

9. CONDITIONING

9.1 Thermal — The thermal conditioning shall be done:

a) for non-heat dissipating items — in accordance with IS:9000 (Part III/Sec 2)-1977* or IS:9000 (Part III/Sec 3)-1977*, and

b) for heat dissipating items — in accordance with IS:9000 (Part III/Sec 4)-1977* or IS:9000 (Part III/Sec 5)-1977*.

9.2 Electrical Stresses — When required, the electrical stresses shall be applied to the components throughout the duration of the test in the manner specified in the relevant specification.

9.2.1 The relevant component specification shall specify the following electrical stresses to be applied to the components during the test:

a) Electrical load (test voltage and test current), and

b) Duty cycle.

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*Basic environmental testing procedures for electronic and electrical items: Part III Dry heat test:

Section 2 Dry heat test for non-heat dissipating items with sudden change of temperature.

Section 3 Dry heat test for non-heat dissipating items with gradual change of temperature.

Section 4 Dry heat test for heat dissipating items with sudden change of temperature.

Section 5 Dry heat test for heat dissipating items with gradual change of temperature.

10. INTERMEDIATE MEASUREMENTS

10.1 The relevant component specification may call for measurements during or at the end of conditioning while the component is still in the chamber. If such measurements are required, the relevant specification shall define the measurement(s) and period(s) after which they shall be carried out. For these measurements, the component shall not be removed from the chamber.

NOTE — Measurements preceded by recovery, which would require removal and reintroduction of the items into the chamber, are not permissible during the conditioning.

If it is desired to know the performance of the types of item before the end of the prescribed duration, one additional lot will be required for each specified duration. Recovery and final measurements shall be performed separately for each lot.

11. RECOVERY

11.1 The component shall remain under recovery conditions for a period adequate for the attainment of temperature stability, with a minimum of 1 hour.

11.1.1 When several components are tested simultaneously and where the 1 hour recovery period is adequate for a single component, the maximum period for recovery shall be 2 hours and all measurements shall be completed at the end of this period.

11.2 If required by the relevant specification, the component shall be switched on or loaded and measured continuously during the recovery period.

11.3 If the standard recovery conditions given are not appropriate for the component to be tested, the relevant specification may call for other recovery conditions.

12. FINAL MEASUREMENTS

12.1 The components shall be visually inspected and electrically and mechanically checked as required by the relevant specification.

13. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

13.1 When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

a) Preparation and mounting;

b) Preconditioning;

c) Initial measurements;

d) Temperature severity (temperature and duration of exposure);

e) Electrical stresses (test voltage, test current and duty cycle), when required;

f) Permissible temperature difference;

g) Intermediate measurements;

h) Period of recovery, if other than that specified in **11**;

j) Final measurements; and

k) Deviation from the normal test procedure, if any.